DESIGN OF A SANITARY SEWER SYSTEM FOR RUSHVILLE, ILLINOIS

BY

C. A. DEAN

ARMOUR INSTITUTE OF TECHNOLOGY

1914

DESIGN
OF A
SANITARY SEWER SYSTEM
FOR THE
CITY OF RUSHVILLE,
SCHUYLER COUNTY,
ILLINOIS.

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A THESIS PRESENTED BY

C. A. Dean

TO THE

PRESIDENT AND FACULTY

OF

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FOR THE DEGREE OF

BACHELOR OF SCIENCE IN CIVIL ENGINEERING,

HAVING COMPLETED

THE PRESCRIBED COURSE

IN CIVIL ENGINEERING.

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Prof Civil Engineering

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CONTENTS.

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INTRODUCTION.

The City of Rushville is located in the central portion of Schuyler County, on the Chicago, Burlington and Quincy Railroad. The population, which is about four thousand, consists largely of well-to-do farmers, and has been slowly increasing for the last fifteen years.

The sewers have been designed to run half full, but the quantities of sewage from the present population do not require a capacity as great as that given by a depth of flow equal to one-half the diameter of the pipe. Thus the sewers as designed are capable of taking care of a population twice as great as that of the present time.

When it is desired to have sewers in some of the outlying sections of the City, smaller systems can be constructed with separate out-falls which may eventually be brought together so that all the sewage from the City is discharged at one outlet.

LAYOUT AND DESIGN OF PIPE LINES.

An examination of the plat showing the topographical features of the ground shows that the general slope is from the northwest to the southeast section of town and therefore the sewers were designed to begin on the north and west sides of the town and run generally towards the south and east. The town is divided into two parts by Congress Street giving two practically separate systems which combine in one outfall. The west half of the town is taken care of by two main sewers running south on Jackson and Monroe streets, combining and running east on Clinton Street and thence through an alley to Morgan Street. The east half of the town is taken care of by a main sewer on Morgan Street running south, combining with the main from the other part of town and continuing to the outfal at Clinton Street and the Cemetry Gate.

The capacities to be taken care of by the pipe lines were figured on the basis of six persons to a fifty foot lot, thus allowing for a population of approximately seven thousand. The quantities of sewage were determined by allowing one hundred ten gallons per capita per day and adding one-third more for leakage of ground water into the sewer.

The pipes were designed to run one-half full and have a capacity such as to enable them to take care of the total discharge of twenty four hours in sixteen hours.

The grades and sizes of pipe were so chosen that the velocity of flow would be between two and one-half and seven feet per second wherever possible.

The capacity is determined by the following formula,

$$Q = AV$$

where, Q = discharge in cubic feet per second.

A = area of cross section of stream in square feet.

V = velocity of flow in feet per second.

The velocity is determined by Chezy's formula,

$$V = C\sqrt{RS}$$

where, C = a constant.

R = mean hydraulic radius in feet.

S = sine of slope.

The coefficient is determined by Kutter's formula,

$$C = \frac{41.66 + \frac{1.811}{n} + \frac{0.00281}{S}}{1 + \left(41.66 + \frac{0.00281}{S}\right)\frac{n}{\sqrt{R}}}$$

The value of "n" the coefficient of roughness has in this case been taken as 0.013.

The following tabulated results were obtained by the use of the above formulas.

For pipes flowing one-half full.

Diam.	R	A	S	C	V	Q
4	.083	.044	.020	63.2	2.57	.113
6	.125	.098	.010	71.5	2.52	.248
8	.167	.175	.006	77.5	2.48	.434
10	.208	.273	.005	82.5	2.66	.727
12	.250	.393	.004	86.5	2.74	1.075
15	.313	.614	.003	91.0	2.77	1.700

The grades shown above were used for the different pipes respectively throughout the system with exceptions as noted.

A flush tank is used at each dead end to assist in the proper maintenance by preventing and removing deposits as well as insuring ventilation. It is advisable that these tanks should discharge from 500 to 800 gallons at least once in twenty four hours intermittently throughout the system.

Man-holes are placed at each street intersection and at intervals so that the distance between man-holes does not exceed 350 feet. In some instances lamp-holes have been used to further aid in the care and maintenance of the sewers.

CONTRACT,

SPECIFICATIONS AND FORMS.

N O T I C E T O C O N T R A C T O R S.

Sealed proposals will be received at the office of the Sewer Commission _____, in the City of Rushville, Illinois, until _____ o'clock _____ , on the _____ day of _____ 19___, for constructing sewers in

_____

_____

Forms of proposals, copies of the specifications and instructions to contractors may be obtained of the Engineer; and the plans and profiles may be seen at his office.

Each bid must be accompanied by a deposit of $_____ as a guarantee of the good faith of the bidder.

The Sewer Commission reserve the right to reject any or all bids.

Address,

_____

_____

_____

Engineer.

T O C O N T R A C T O R S.

1. All bids must be made upon the printed forms, to be obtained at the office of the Engineer, and enclosed in a sealed envelope, directed to the Engineer of Sewers, _____

_____

and endorsed upon the outside of the envelope, PROPOSAL FOR CONSTRUCTING SEWERS IN THE CITY OF RUSHVILLE,

2. Each bid must be accompanied by a deposit of _____ Dollars, to be left in the hands of the City Clerk, subject to the conditions specified in the proposal hereto annexed, as a guarantee of the good faith of the bidder.

3. Bids shall state the price per lineal foot of pipes of each size laid as herein specified, and for the various depths of trench named, also for all other items enumerated in the schedule opposite, which price shall be in full for all labor and materials required for the complete execution of the work.

4. All prices must be written in words, and also stated in figures.

5. The place of residence of each bidder must be given after his signature, which must be written in

full. When firms bid, the individual names of the members shall be signed in full, and the firm name added.

6. The name of the Contractor must be filled in blanks left for that purpose.

7. The City of Rushville reserves the right to reject any or all bids.

8. Bidders are requested to be present at the opening of the bids.

9. The bond required of the successful bidder shall be in the sum of $_____ _____.

P R O P O S A L.

To the SEWER COMMISSION of the City of Rushville, Schuyler County, Illinois.

GENTLEMEN: The undersigned hereby propose to furnish all of the materials and do all of the work required to complete such amount of the above mentioned work as shall be awarded to the undersigned by the City of Rushville in a first class manner, and in accordance with the specifications hereto annexed, and the plans and drawings of the same on file in your Engineer's office, at the following prices, viz:

And _____ hereby agree to enter into a contract within five days from the date of your acceptance of this proposal, to finish and complete said work (by the _____ day of _____), according to the form hereto attached, and the plans and specifications on file in the office of the Engineer, under which the bid was made, and will furnish such sureties for the faithful performance of such contract, the payment for materials contracted for, and for the payment of laborer's wages and liens which may arise therefrom, as shall be approved by the Sewer Commission.

In default of the performance of any of the conditions on _____ part to be performed, the sum of _____ Dollars, which _____ have this day deposited with the Sewer Commission, shall, at the option of the Sewer Commission, be absolutely forfeited to the City of Rushville, but otherwise said sum of _____ Dollars shall be returned to _____.

Dated at _____ _____ the _____ day of _____ 19___.

(Contractors Signature,)_____

_____

(P. O. Address,)_____

No._____ (State,) _____

No._____ _____

City Clerk.

A R T I C L E S O F A G R E E M E N T.

BETWEEN THE CITY OF R U S H V I L L E, ILLINOIS,
PARTY OF THE FIRST PART, AND _____,
CONTRACTOR, PARTY OF THE SECOND PART, FOR BUILDING ____
_____ SEWERS
IN _____
_____

****

This Agreement, made and entered into this _____ day of _____ in the year one thousand nine hundred _____, by and between the City of Rushville party of the first part, and _____ Contractor__, party of the second part.

WITNESSETH, Whereas, The City of Rushville in the State of Illinois, by virtue of the authority vested in the Sewer Commission by the Legislature of the State of Illinois and the Ordinances of the City of Rushville, agree to let unto _____ Contractor__ the work of constructing certain _____ _____ Sewers, as per plans and profiles of the work on file in the office of the Engineer of Sewers.

NOW, THEREFORE, in consideration of the payments and covenants hereinafter mention to be made and performed by said party of the first part, the said _____ hereby covenants and agrees to do the work mentioned in a substantial and workmanlike manner, in conformity with the plans, profiles and specifications of such work on file in the office of the Engineer, in strict obedience to the directions which may from time to time be given by the said Engineer or his duly authorized assistants, and in accordance with the following specifications.

CONTENTS OF SPECIFICATIONS BY PARAGRAPHS.

S P E C I F I C A T I O N S

for the

MATERIALS AND CONSTRUCTION OF SEWERS

in

CITY OF RUSHVILLE, ILL.

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(1.) DEFINITIONS.

Wherever the words "Sewer Commission" occur in these specifications they shall be interpreted to mean the Sewer Commission of the City of Rushville, and any of its authorized representatives; provided, however, that such persons shall be understood to represent said Commission only to the extent of the special duties imposed upon such representatives.

Wherever the word "Engineer" occurs in these specifications, it shall be interpreted to mean the Engineer in charge of the sewers, or his duly authorized assistant.

Wherever the word "Contractor" occurs in these specifications, it shall be interpreted to mean the person or persons, firm or corporation to whom the work herein specified is awarded, and the agents, employes, workmen or assignees thereof.

Wherever the word "work" occurs in these specifications, it shall be interpreted to mean the work, including all material, labor and use of tools necessary to complete the improvement in full compliance with the terms of these specifications.

Wherever the word "rock" occurs in these specifications,it shall be interpreted to mean any material geologically in place and of a hardness when first exposed of three or greater in the scale of mineral hardness, which corresponds to the hardness of the transparent variety of calcite. Other materials shall not be classed as rock, although it may be more economical to remove the same by blasting.

(2.) NATURE OF THE WORK.

The contractor shall, for the contract price per lineal foot for the sewer proper, furnish all the material and all tools and do all the work prescribed in these specifications and shown on the plans attached, including foundation and all necessary work and material for building of outfall, shall make the requisite excavation for building the sewer, and its appertaining structures and connections, shall do all the ditching, diking, pumping, bailing and draining, all sheeting and shoring; shall make all provisions necessary to maintain and protect all buildings, walls, fences, trees, gas pipe, water pipe, conduits, sewers and other structures

of whatever nature; shall provide all bridges, fences or other means of maintaining travel on intersecting streets, and on streets or roads in which trenches are excavated; shall maintain the same in good and safe condition so long as may be necessary, and then shall remove such temporary expedients and restore such ways to their proper condition; shall provide watchmen, fences, red lights and all other precautionary measures necessary to the protection of person and property; shall provide centers and forms; shall construct all foundations, all brick, tile pipe, concrete, stone and timber work; shall set in place all iron work, and refill all trenches; and shall put in complete working order the sewer or sewers awarded him, and shall do each and all to the satisfaction of the Sewer Commission. The contract price is to include the cost of removal of trees, roots, timber or masonry structures or other obstacles, and the delay or damage occasioned by same, whether any of these obstacles are shown on the plan or not.

(3.) LOCATION.

The sewers shall be located on the lines shown on the plans of the work, and will be staked out by the Engineer. This line, whenever practicable, will be on the centre line of the street. The Commissioners, however, reserve the right to move the line of sewers to the right or left whenever obstructions are met which

render a change of line desirable.

The Contractor will be required to preserve all stakes and bench marks until permission is given by the Engineer to remove them.

The line for trenches will be indicated by stakes set at one side of the trench. A width of at least two feet, on the side of the trench where the stakes are placed, shall, as the work progresses be kept free from obstruction.

(4.) EXCAVATION.

All excavations shall be by open cut from the surface, except where tunneling is considered necessary or proper by the Engineer, in such direction as is required, to the width and depth as may be necessary for the proper construction of sewer according to plan.

The Contractor will be required to keep the sides of the excavation vertical by bracing or otherwise; but no allowance will be made therefor unless the same is left in the trench by written order of the Engineer.

The trenches must be of sufficient width to admit ample room within the lines of the sheeting to permit the work to be constructed in the manner and size specified.

Where the nature of the ground will admit it, the bottom of the excavation shall be made and shaped as

nearly as possible to fit the lower half of the pipe to be laid, with holes cut at the joints for the sockets to rest in so that the pipe shall have a uniform bearing on the ground from end to end.

If the character of the ground met with in excavating be such that the external form of the sewer cannot be preserved, the excavation shall be made to conform as nearly as possible to the external shape and dimensions of the sewer, and the space between the external sewer lines and the bottom and sides of the excavation as made, shall be filled by the Contractor with dry earth, crushed stone, or gravel well compacted so as to give a uniform bearing from end to end.

At the height of half of the diameter of the pipe from the bottom, that is, at the height of the greatest horizontal diameter of the pipe, all trenches are to be eighteen inches wider than the greatest internal diameter of the pipe to be laid therein.

The trench shall be dug to within six inches of grade by measurement from the witness stakes on the surface. The last six inches shall be taken out after the grade pegs have been set in the bottom of the trench by the Contractor under the direction of the Engineer.

The excavations for all man-holes, flush tanks, and other accessories shall be sufficient to leave at least one foot in the clear between their outer surfaces and the embankment or timber which may be used to protect them.

The approximate depth of the cutting will be given by the Engineer before the excavation is begun. Grade and line will be given by the Engineer every twenty-five (25) feet at the bottom of the trench, on stakes furnished and set by the Contractor; or on overhead pieces, from which the position of the invert may be determined by a line parallel therewith.

In estimating the number of cubic yards of ordinary excavation, an arbitrary width of trench equal to the internal diameter of the sewer pipe in feet plus one and one-half feet will be taken, which multiplied by the average depth gives the area of a rectangular section upon which estimates of quantities will be based, no allowance being made for excavation beyond these boundaries.

In no case shall more than five hundred (500) feet of trench be opened in advance of the completed sewer, except where, in the opinion of the Engineer, it is necessary to drain wet ground, and written permission is given the Contractor.

Where streets are paved all surplus excavated material must be removed from the trench and the streets as fast as excavated by the Contractor, at his own expence. Other material excavated shall be laid compactly on the sides of the trench and kept trimmed up so as to be of as to be of as little inconvenience as possible to the traveling public and adjoining tenants. The sidewalks must in no case be obstructed, and the Contractor shall

make provisions at all crossings for the free passage of vehicles and foot passengers, either by bridging or otherwise.

On all streets the material excavated and the materials used in construction of the sewer shall be so placed as not to endanger the work, not to obstruct the gutter of any street or the free passage of surface water along the gutters, and so that free access may be had at any time to all parts of the trench and to all fire hydrants and water valves in the vicinity.

All paving, gravelling, macadamizing, planking, sidewalks, culverts and crosswalks, or any street paving or walk whatever, shall be carefully removed, before the excavation is made, kept separate from the other excavated material, and carefully replaced after the sewer is completed.

No tunneling will be allowed except upon written permission from the Sewer Commission. The tunnels shall be of such width and height as the Engineer may direct, and shall be excavated in comformity with the cross-section to be approved by him.

No additional compensation shall be allowed for excavating man-holes, or flush tanks over the price per lineal foot of trench.

(5.) ROCK CUT.

Where rock is encountered in excavating the trenches, it is to be removed by drilling and blasting or otherwise, to the level, six inches below the inside of the bottom of the sewer. The refilling from the bottom of the trench to one foot above the bell of pipe shall be of earth, free from stones, or such material as shall be approved by the Engineer. The material is to well rammed into its place and will be furnished by the Contractor without extra compensation.

When blasting is resorted to for making the excavations, the trench shall be covered carefully on the top and sides with heavy timbers or plank, to prevent fragments of rock from being thrown out, endangering both life and property.

No blasting shall be done within twenty (20) feet of the finished sewer or within ten (10) feet of an uncovered gas-pipe or water-pipe, and the end of the finished sewer shall be covered or stopped with plank or earth during each blast.

All damages or injury to persons or property resulting from blasting operations, or from neglect in properly guarding the trenches, must be paid by the Contractor; and no compensation to said Contractor for losses thus incurred will be allowed.

The Contractor shall strip rock in sections of not less than fifty (50) feet in length, and shall not blast the same until notified by the Engineer that

the elevation of the rock has been taken.

For all rock excavation, in addition to the price per foot of sewer, the Contractor will receive a compensation of three dollars ($3.00) per cubic yard. In estimating the number of cubic yards of rock cut, an arbitrary width of the trench equal to the internal diameter of the sewer plus two feet will be taken, which multiplied by the depth from the surface of the rock to the level six inches below the inside bottom of the sewer, will be the area of the rectangular section upon which estimates of quantities will be based, no allowance being made for excavation beyond these boundaries and no deduction made for the portion which may not be removed, provided, that in no case shall less than one foot in depth be allowed. Boulder, one-quarter (1/4) cubic yard and over in size, will be measured as rock excavation.

No claim for an amount of money beyond the contract price of the work will be entertained or allowed on account of the character of the ground in which the trench or other excavations are made, except for the rock cutting here-to-fore specified.

The Contractor must assume the risk of meeting quicksand, hardpan, boulder clay, rubbish, unforeseen obstacles, underground conduits, railroad tracks, pavements, etc.

(6.) SHEETING AND BRACING.

In case the depth of the excavation or the character of the ground, shall render it necessary to secure the protection of the work, the adjacent streets, buildings, or other improvements, the Contractor must furnish and put in place at his own expense, braces, sheeting, etc., as may be necessary for the safety of the work, the public or adjacent property.

The sheeting and bracing shall be removed as the work progresses, in such manner as to prevent the caving in of the sides of the excavation, or any damage to the masonry.

The Sewer Commission may order the sheeting and bracing left in, when in its opinion it is necessary for the protection of the work, the public or adjacent property; in such cases a charge will be allowed for the same at the rate of fifteen dollars ($15.00) per thousand feet B. M.

The Contractor shall at his own expence shore up and restore, and make good, as may be necessary, all fences, buildings, walls, or other property which may be disturbed during the progress of the work, and said Contractor will be held responsible for all damages which may happen to neighboring property, or in any way from neglect of this precaution.

The price paid per lineal foot of sewer shall include the cost of all temporary supports and braces that

may be necessary to secure a safe prosecution of the work until the permanent structure is complete; such temporary supports must in all cases be removed by the said Contractor at his own expense after or concurrently with the completion of the permanent structure.

(7.) FOUNDATIONS.

Wherever the ground is sufficiently firm and unyielding, the masonry or pipe are to be laid directly on the bottom of the excavation; but, wherever this is not the case, the Contractor shall furnish and put into place without expence sand, gravel or other suitable material.

Wherever a foundation not shown on the plan is considered necessary and is advisable in the opinion of the Engineer, it shall be built of masonry, concrete, or of plank and timber, as the Sewer Commission may direct.

The Contractor will be allowed extra compensation for this work at the prices named below for the different kinds of foundations required.

The following are the prices to be paid for the various foundation:

$15.00 per 1,000 feet board measure for lumber.

$ 8.00 per cubic yard for brick masonry.

$ 7.00 per cubic yard for concrete.

If the Contractor excavates below the proper grade without orders from the Engineer, he will be required, at his own expense, to fill the excess of exca-

vation with such material as the Engineer may direct.

Concrete foundations are to be placed under all man-holes and flush tanks with out addition compensation, the price of the same being included in the cost of the fixture.

(8.) PROTECTION AGAINST WATER.

The Contractor shall provide for all water courses and drains interrupted during the progress of the work, and replace them in as good condition as he found them.

The Contractor shall do all pumping and bailing, build all drains, and do all other work necessary to keep the trench and sewer clear of ground water, sewage, or storm water during the progress of the work, and until the cement mortar is sufficiently set to be safe from injury. No pipe or masonry shall be laid in water. To this end, in wet trenches the Contractor shall keep a channel open on each side of the work during its progress, which shall be maintained so as to catch the water from the sides of the trench and conduct it to a sufficient sump or bail hole in front of the work.

All pipes must be kept thoroughly clean, and no water will be allowed to flow through them, during the construction of the sewers.

When the trench is left for the night, or the pipe-laying is stopped by rain storms or any other cause,

the ends of the pipes must be closed water-tight with bricks and cement.

When running quicksand or other treacherous ground is encountered, the work shall be carried on day and night, should the Engineer require it.

(9.) PROTECTION OF WATER AND GAS PIPES, ETC.

The Contractor shall do whatever may be necessary to keep in position and to protect from injury all water, gas, or other pipes or conduits either until the sewer is built and the backfilling finished, or if it be necessary, until the proper person removes or changes them. Nothing in this contract shall be so construed as to relieve any person or corporation, owning or using any pipes, conduits or tracks, from the obligation to maintain and protect such pipes, conduits or tracks, without any expense to the City of Rushville or to the Contractor building said sewer.

The Contractor shall ascertain for himself the existence and location of all water service pipes which may be encountered during the construction of this improvement. Where water service pipes are removed, cut or damaged in any way an account of the construction of this sewer, the Contractor shall at his expence at once cause the water service pipes to be replaced or repaired in a careful and workmanlike manner. In no case shall the Contractor receive extra compensation, in any form,

for the removal, maintenance, repairing or replacing or extra labor involved on account of water service pipes encountered.

(10.) EMBANKMENT.

Where embankment is necessary to support the foundations of the sewer, it shall be made of the width and slopes shown on the plan. The surface of the ground receiving the embankment shall be carefully cleared of all muck or unsuitable material, of whatever nature.

The embankment shall then be formed of good loam or gravel, free from all stones over four inches in diameter, and of those below that size in a proportion not exceeding one part of stone to three parts of earth in any place.

The material is to be deposited in layers of not more than six inches in thickness, each layer to be separately compacted by heavy iron rollers, or, where these cannot be used, by heavy paver's rammers. No breaks, steps or irregularities in the distribution of material or formation of the layers will be allowed, and the whole embankment is to be carried up evenly so as to make a compact and solid foundation.

(11.) PIPE LAYING.

Each pipe shall be laid on an even, firm bed so that no uneven strain will come on any pipe and particular care shall be excerised to prevent the pipes bearing on the sockets.

Each pipe shall be laid in conformity with the line and levels given by the Engineer and in the presence of the Inspector.

All pipes over eight inches in diameter shall be laid with a straight edge. One end of the straight edge shall be placed on the nearest grade peg and the other on the flow line of the pipe already laid, and the pipe shall be so adjusted as to be in contact with the straight edge throughout its length.

All pipes eight inches and less in diameter, except house branches, shall be laid in following manner: A mason's line shall be tightly stretched parallel to the grade and slightly above the sockets of the pipes. This line shall be supported over the centre at distances not greater than twenty-five (25) feet apart. The exact grade for each pipe shall be obtained by measuring down from this line to the invert of the sewer.

All pipes, previous to being lowered into the trench, shall be fitted together and matched, so that when joined in the trench they may form a true and smooth line of pipes. No pipes shall be trimmed in any case. Pipes which do not fit truly shall be rejected.

(12.) JOINTS.

A gasket of oakum or other material approved by the Engineer shall be pressed into the joint around the entire circumference of the pipe to prevent the entrance of cement to the inside of the pipe. No joint shall be cemented until the gasket of the next joint in advance has been completed.

The cement shall be pressed into the space between the socket and the spigot so as to entirely fill the space, and the bevel joint at the end of the socket shall be smoothly and evenly made. Special care must be taken to make perfect joints at the bottom of the pipe.

The excavation made for the socket of the pipe shall be filled with sand to support the cement firmly in position.

When the joint is completed great care must be taken not to disturb the pipes.

(13.) BACK-FILLING.

All pipe sewers as soon as laid shall be covered with earth to a depth of at least two (2) feet. No rock or other hard substance shall be placed in contact with the pipe. As soon as mortar and masonry are sufficiently set, the trench shall be sufficiemtly filled to prevent liability of injury to the banks, road surfaces, adjacent pipes, railroad tracks, sidewalks, or other property, public or private.

The trench shall then be flooded and the back-filling completed. The back-filling shall in all cases be left with a smooth and even surface and a sufficient crown. Where required, the back-filling shall not be left unfinished more than five hundred (500) feet behind the completed pipe work.

The Contractor is required not to sell, remove or permit to be removed from the line of work, before the trench shall have been refilled, any sand, gravel or earth excavated therefrom which may be suitable and required for refilling.

The trench must in all cases be filled to the proper grade. Should there be a deficiency of the proper material for refilling the trench as required, the Contractor will be required to furnish the same at his own expense.

All surplus material not otherwise disposed of shall be removed at once by the Contractor at his expense. In no case shall the excavated material be left above the established grade of the street.

All rubbish must be removed and the surface must be left in as good condition as it was before the commencement of the work, and it must be maintained in such condition during the period of one year after the acceptance of the work.

(14.) FILLING.

The sewers shall in all cases be covered with earth to a depth of not less than three feet, and where the trenches do not furnish sufficient material the Contractor shall supply such deficiency at his own expense.

When additional filling is required to be placed over the sewer for its protection, the Contractor shall furnish and spread earth, cinders or clean ashes, free from animal or vegetable matter, in such a manner and in sufficient quantities so that after it is thoroughly compacted the embankment will be of uniform grade and cross section.

(15.) RESTORATION OF CROSSWALKS.

All cross-walks removed or damaged by the Contractor shall be replaced without delay after the completion of the sewer proper.

(16.) REPAVING AND RESTORING SURFACE OF STREETS.

In all streets or parts of streets that are paved or macadamized, all back-filling shall be well compacted and when so directed by the Engineer, the back-filling shall be puddled. After being puddled or rammed to the required height, the pavement shall be relaid carefully and thoroughly in a manner adapted to its peculiar character.

All work of restoring the surface of the streets shall be done to the satisfaction of the superintendent of streets.

When the work is completed, all surplus material, earth, rubbish, etc., shall be removed and the surface of each street included in this contract shall be left in as good condition as it was before the commencement of the work, and it shall be maintained in such condition during a period of one year after the acceptance of the work.

(17.) BRANCHES, SIDE JUNCTIONS, ETC.

The "Y" branches, "T's", lamp-holes, hand-holes, and man-holes shall be placed at points indicated by the Engineer. They shall not be covered until he has noted and recorded their exact position.

The "Y" branches shall be elevated to correspond to the lateral sewers and house drains entering them. They shall be closed with an earthenware cap, and the space above the cap shall be filled with sand, covered with a thin coating of cement.

All house connections are to be four inches in diameter. House branches shall be laid to a point just within the curb lines where the Engineer shall direct.

(18.) LAMP-HOLES.

Lamp-holes shall be constructed by placing an eight inch "T" branch vertically in the sewer, and bringing it up to within one foot of the street surface by adding pipes of the same diameter. The top of the lamp-hole shall be protected by a cast iron cover, the curb of which rests on a brick masonry foundation. A masonry arch will be built over the main sewer pipe supporting the weight of the pipe forming the lamp-hole .

(19.) MAN-HOLES.

The Contractor shall build the various man-holes in the position shown on the plans or where directed by the Engineer, in accordance with the detailed drawings.

The man-holes shall be constructed of hard brick, laid in cement mortar, plastered outside with cement mortar, and washed inside with pure cement. All man-holes shall be circular in section and four (4) feet internal diameter throughout the lower four (4) feet, and two (2) feet internal diameter at the cover. The thickness of the wall shall be eight (8) inches. Arches shall be turned over the pipes entering the man-hole so as to relieve them from pressure due to the weight of the masonry above.

The bottom shall be formed of concrete and the top of the concrete shall be on a level with the

bottom of the sewer pipe. The top of the cover shall be on a level with the street surface at a grade given by the Engineer.

Particular care must be taken in forming the bottom of man-holes to make the curves of the tributary sewers as easy as possible and to allow no places for deposit to take place. They shall have proper channels formed across them to lead the sewage from one sewer to another without interruption to the flow, and where possible there shall be a fall of not less than two-tenths (0.2) foot in man-holes where there is a change in the direction of flow.

(20.) FLUSH TANKS.

Flush tanks shall be constructed of hard-burned bricks carefully laid in cement mortar so as to be water tight. They shall be plastered outside and inside with cement mortar.

The emptying device for the flush tanks shall be selected by the Sewer Commission and shall be some type approved by the Engineer.

The Contractor shall at his own expense furnish and make all connections to the flush tanks from adjoining water mains in a satisfactory manner; and set in place properly all necessary siphon, regulating, feeding, overflow and vent pipes, lamp-holes, stopcocks and devices. Siphons shall be set in a mass of concrete. The tapping of the water main shall be at the expense of the Contractor.

(21.) CENTERING AND PATTERNS.

The center, patterns and templets necessary in the construction of the work, in accordance with the plans and directions given, are to be furnished by the Contractor, at his own expense. They are to be so made as not to yield under any pressure to which they may be subjected, and shall not be withdrawn until the concrete or masonry has set to the satisfaction of the Engineet.

(22.) LADDER IRONS.

In each man-hole and flush tank there shall be placed iron ladder steps spaced eighteen (18) inches apart vertically. Each step shall be twelve (12) inches wide, shall extend six (6) inches from the face of the brick work and the ends of the step shall extend completely through the walls. Each step shall be made of galvanized wrought iron rods, three-quarters (3/4) of an inch in diameter.

(23.) CAST IRON COVERS.

All covers used for lamp-holes, man-holes and flush tanks shall be made of a good grade of cast iron and shall conform to the shape and dimensions shown on the plans.

All covers shall be made from a superior quality of gray iron, tough and of even grain, without blow-holes or sand-holes or defects of any kind; and

shall be thoroughly clean and shall have a workmanlike finish.

The cast iron shall possess a tensile strength of not less than eighteen thousand (18,000) pounds per square inch and test pieces one and a quarter (1.25) inches in diameter, when placed upon supports twelve (12) inches apart and loaded in the centre, shall have a minimum transverse breaking load of twenty-nine hundred (2,900) pounds, and shall have a total deflection of not less than one-tenth (0.10) of an inch before breaking.

(24.) MATERIALS.

All materials, of whatever nature, required in the construction of the sewers and appurtenances, shall be of the best quality, and shall be furnished by the Contractor.

All work shall be executed in the best and most workmanlike manner and no improper material shall be used, but all materials of every kind shall fully answer the specifications, or if not particularly specified, shall be suitable for the place where used and entirely satisfactory to the Sewer Commission.

In order to afford the Engineer ample opportunity for inspection, all material shall be at the location of the work at least three (3) days before it is used.

(25.) EARTHENWARE PIPE.

All sewer pipe and specials, unless otherwise specified, shall be of the best quality, salt-glazed, vitrified clay pipe of the hub-and-spigot pattern, sound and well burned throughout their thickness, impervious to moisture, of smooth well glazed exterior and interior surfaces, free from laminations, cracks, flaws, blisters, fire checks, and all other imperfections, circular in bore, of true form in their length, whether straight or curved, internally of the exact specified diameter, and of uniform standard thickness.

All pipe shall have true and circular sockets concentric with the bore of the pipe and shall be furnished in pieces two feet (2'-0") long. For all junctions, a well fitted vitrified stopper shall be furnished without charge.

A "Y" branch connection of four (4) inches in diameter shall be provided every twenty-five feet on each side, when ordered by the Engineer.

No pipe shall be used which, designed to be straight, varies from a straight line more than one-cigth (1/8) inch per foot of length; nor shall there be a variation between any two diameters of the pipe greater than two percent (2%) of the nominal diameter.

Pipes or specials having fire checks or cracks of any kind extending through the thickness and having a length greater than the depth of the socket shall be rejected.

No pipe will be accepted which has a piece broken from the spigot that is longer than the socket, nor which has a piece broken from the socket end, if the fracture extends into the body of the pipe or if its greatest length is greater than one-sixth (1/6) the diameter of the pipe, or if such fracture cannot be placed at the top of the sewer.

All pipe shall be subject to inspection and approval or rejection of the Engineer, and all rejected pipes shall upon notice be removed from the line of work by the Contractor.

(26.) IRON PIPE.

Iron pipe shall be used where the sewer runs under or through waterways (either natural or artificial) or under a railroad, or wherever it is deemed necessary by the Engineer.

The quality of the cast iron shall be the same as specified for man-hole covers. The joints shall be of lead properly caulked. The lengths of pipe, their diameter and thickness shall be as directed by the Engineer. The weight of each pipe shall be plainly marked on it before leaving the factory.

Iron pipe shall be paid for by the ton, laid in place with joints complete.

(27.) BRICKS.

The bricks shall be of the best quality of sewer brick, of compact texture, uniform quality, sound and hard burned, free from lime and cracks, with a clear ringing sound when struck, whole and with edges full and square, and of standard dimensions, viz: eight and one-quarter by four by two and one-quarter inches. The bricks when thoroughly dried and immersed in water for twenty-four (24) hours shall not absorb more than ten (10) per-cent in weight of water.

If in any load of bricks more than ten (10) percent are inferior, the whole load will be rejected. If less than ten (10) percent are inferior, the bricks may be accepted, provided the Contractor will at his own expense cull out all inferior bricks. All rejected bricks must be removed from the location of the work at once.

All bricks are to be thoroughly wet immediately before laying. Every brick is required to be laid in a full and close joint of cement mortar, on its beds, ends, and sides, at one operation. In no case is mortar to be slushed in afterwards.

(28.) CEMENT.

The cement shall be fresh made, and of some satisfactory and reliable brand, and of such quality and uniformity as has been demonstrated in years past to be of superior quality and thoroughly adapted to the con-

struction of sewers and similar work, and which has been approved by the Engineer.

The cement shall be so finely ground that eighty (80) percent will pass through a standard sieve of one hundred (100) meshes to the lineal inch, and when tested in the usual manner for tensile strength, shall give results comparing favorably with the best brands of American cement.

Every facility for inspecting and testing the cement shall be furnished by the Contractor.

(29.) MORTAR.

All cement mortar for lamp-holes, man-holes, flush tanks and concrete, shall be made of best quality of fresh ground _____ cement and clean sharp sand in the proportion of one measure of cement to two of sand. The sand and cement shall be thoroughly mixed dry, and such quantity of water added as to from a paste of the proper consistency. All mortar shall be fresh for the work in hand and no retempering will be allowed. No mortar that has begun to set shall be used.

The neat cement used in filling the joints shall be made of the specified cement with only enough water added to give it proper consistency, and shall be mixed only as needed for use.

(30.) CONCRETE.

The concrete used on the work shall be composed of a 1:2:4 mixture made up of one part cement, two parts sand, and four parts of crushed stone or gravel such as will pass in every way through a two (2) inch ring.

All material shall be actually measured for each batch. In hand mixing, the sand shall be spread out upon a suitable platform or box and the cement deposited upon this; these shall then be thoroughly mixed dry until the whole is of an even, uniform color, when sufficient water shall be added to form a thick paste. The stone, which has previously been thoroughly wet, shall then be added and the whole shall be quickly and thoroughly mixed, until every stone is coated with mortar, water being gradually added by sprinkling, if necessary, to obtain a better consistency. If mixing be done by machinery the mixer employed shall permit of actually measureing materials and producing a thorough mixture of the same. Whether, hand or machine mixing be employed, the mixing shall be as thorough as is practically obtainable.

Concrete must not be mixed in quantities greater than required for immediate use, and any which has begun to set shall not be retempered or used in any way. Concrete shall be mixed sufficiently wet to settle to place against the forms by light ramming, which shall bring the water to the surface. The forms shall be sufficiently tight to prevent leakage of water through them.

Where fresh concrete is to be placed in contact with that already set or partly set all loose stone of concrete not thoroughly compacted shall be removed from the surface of the latter, which shall be washed clean of all dirt and and given a thin coat of mortar. If such surface be hard set it shall be previously thoroughly water-soaked. When concrete is in place all wheeling, working, or walking on it must be prevented until it is firmly set, and until such time it shall be kept damp and protected from the sun.

No concrete shall be made or used when the temperature is below thirty degrees Fahrenheit without the permission of the Engineer, whose instructions and restriction for such use shall be followed.

(31.) PROTECTION AGAINST ACCIDENTS.

The Contractor shall erect suitable barriers around all excavations, to prevent accidents to all people on the streets, and shall place and maintain during the night sufficient lights on or near the work.

In addition to the necessary barriers and lights required about the trench, a watchman shall be employed on the work at night whenever in the opinion of the Engineer it shall be necessary.

The Contractor shall have charge of, and be responsible for, the entire line of sewers for whose construction he has contracted, until their completion and acceptance. He shall also be liable for any defects which may appear in his work before the final payments specified herein.

(32.) USE OF VACANT LOTS.

The Contractor will not be allowed to occupy or use any vacant lot as a depository for stone, sand, gravel or other material, without written permission of the owner or agent of the land, a copy of which shall be filed with the Sewer Commission.

(33.) DIRECTION AND SUPERINTENDENCE.

The Contractor shall perform all of the work herein specified under the direction and superintendence of the Sewer Commission and to its entire satisfaction, approval and acceptance.

All material to be incorporated in the work, all labor performed, and all appliances, tools and methods used shall be subject to the inspection and approval or rejection of the Sewer Commission.

The Sewer Commission shall decide all questions relating to measurements, the materials used, the character of the work performed and as to whether the rate of progress is such as to comply with these specifications.

If any authorized agent of the Sewer Commission shall point out to the Contractor, his foreman or agent, any neglect or disregard of the specifications, such defects shall at once be remedied and further defective work discontinued; but the right of final acceptance or condemnation of the work will not be waived by reason thereof, nor by any other act of the City of Rushville, by its officers or agents.

If at any time during the progress of the work any material is rejected, or if any of the work is wholly or in part improperly constructed, then the Contractor at his expense shall immediately remove all rejected material and shall reconstruct all work improperly done.

The Sewer Commission shall have the authority to order the dismissal of any employee on the work, who refuses or neglects to obey any of its instruction or those of its inspectors, relating to the carrying out of the provisions and intent of these specifications, or who is incompetent, unfaithful, abusive, threatening or disorderly in his conduct, and such person shall not be again employed on the work.

All work under this contract must be conducted in the presence of the Engineer or Inspector during regular working hours, unless special permit is granted by the Sewer Commission to conduct the work at other periods. No work is to be covered until it has been examined by the Engineer or Inspector.

The Contractor shall notify the Sewer Commission forty-eight (48) hours before beginning work on this contract of his intention to do so and in case of a temporary suspension of the work he shall give a similar notice before resuming work.

The Contractor shall give notice in writing, at least twenty-four (24) hours before breaking ground, to all persons (Superintendents, Inspectors or otherwise) in charge of property, streets, gas pipes, water pipes, railroads or otherwise, that may be effected by his operations.

And it is further agreed that the Contractor shall not cause any hindrance to or interference with any such company or companies in protecting their said work; but, will suffer said company or companies to take all such measures as they may deem necessary for the purpose aforesaid.

The Contractor shall furnish all necessary facilities, should it be deemed advisable by the Sewer Commission to make an examination of any work already completed. If the work is found defective in any respect, the Contractor shall defray the expense of such examination and of satisfactory reconstruction. If the work is perfect, such expense will be allowed for by the Sewer Commission.

The Sewer Commission shall at all times have access for inspection to all branches of the work on the street, or at the plants where material is stored, prepared or being mixed; and the Contractor shall furnish from time to time such samples of each separate ingredient or ingredients in combination of materials to be used in the improvement as may be requested by the Sewer Commission.

When deemed necessary by the Sewer Commission, the Contractor shall store separately in such manner as to admit of identification any or all material which he proposes to incorporate in this improvement.

(34.) EXTRA WORK.

The actual length of each sewer to be built may be more or less than the corresponding length given in the proposal sheet or plan, but no variation will be made in the rates on that account. No extra or customary measurement of any kind will be allowed in measuring the work under these specifications; but the actual length area, solid contents or number shall be considered and the length shall be measured on the center line of the work whether straight or curved. The Contractor will be paid the contract price for each unit of work done, which price will include the cost of all work herein described, including all junctions, lamp-holes, man-holes, and flush tanks, with their connections.

No claim whatever will be allowed the Contractor for extra work or material or for a greater amount of money than is herein stipulated to be paid, unless some change in or addition to the work requiring additional outlay by the Contractor is first ordered in writing by the Sewer Commission. Said writing shall state that such work is not included in the contract, what the extras are, and that they are necessary for the proper completion of the work or for the security of the work previously done, and the reasons why such extras are necessary.

The Sewer Commission reserves the right to make any change un the plans and specifications that it may deem desirable or necessary either before or after the commencement of the work, which change may increase or diminish the quantity of material or labor or the expense, and such change shall not violate or annul the contract or agreement hereby entered into, but the Contractor shall furnish the necessary labor and material to complete the contract as amended. The value of the work so added or omitted shall be added to or deducted from that contract price as the case may be, and the determination of such value shall be based on the rates and prices named in this contract, when such rates and prices can be equitably applied, otherwise the value shall be determined by mutual agreement between the Sewer Commission and the Contractor. If such change diminishes the quantity of work to be done, it shall not constitute a claim for damages, or for anticipated profits on the work dispensed with.

If, for any cause, the Sewer Commission finds it necessary or desirable to suspend operations for any considerable length of time, it shall be done by the Contractor on due notification, and he will not be entitled to any damages of any kind or nature whatsoever because of such detention. He will, however, be allowed further time in the completion of his contract, equal to the delay caused by the suspension of the work.

All loss or damage arising out of the nature of the work to be done, or from any detention or other unforseen or unusual obstruction or difficulty, which may be encountered in the prosecution of the work, or from the action of the elements, shall be sustained by the Contractor. No variation from the regular prices named in the proposal will be made or allowed, whether the material through which the trenches are excavated is hard or soft, or whether it is composed of rock, boulders, walls or common earth. The Sewer Commission will not consider themselves bound to notify or inform contractors where material that is hard or expensive to excavate occurs, or will be liable to be encountered. Furthermore no compensation for trenching done in excess of the orders of the Engineer will be allowed.

(35.) GENERAL STIPULATIONS.

The Contractor shall start work at such points on the line of the sewer as the Engineer may from time to time direct, and shall progress from the outlet, or towards the outlet, at the option of the Engineer.

No pipes or masonry shall be laid in freezing weather.

The sewers, after completion, are to be left entirely clear of rubbish of every kind and description. The dead ends are to be carefully closed with brick and mortar, so as to exclude all running sand and other material.

The Contractor shall take out, at his own expense, all necessary permits from the municipal or other public authorities, shall give all notices required by the law and municipal ordinances, and shall pay all fees and charges incident to the due and lawful prosecution of the work covered by this contract, and shall comply with all laws and regulations.

Necessary sanitary conveniences for the use of laborers in the work, properly secluded from public, shall be constructed and maintained by the Contractor in such manner and at such points as shall be approved by the Engineer, and their use shall be strictly enforced. The collection in the same shall be removed when and where in the opinion of the Engineer, it is advisable. The Contractor shall supply sufficient drinking water to all of his employees, but only from such sources as are approved by the Engineer.

(36.) TIME FOR COMPLETION.

The work embraced in this contract shall be begun within _____ days after the award of this contract, and carried on regularly and uninterruptedly thereafter, with such a force as to secure its full completion by _____; but should the work be interrupted or delayed by the City, after the service of such notice, the Contractor shall be entitled to an extension of time equal to the time of such interruption or delay,

which shall be determined by the Engineer; the time of beginning, rate of progress, and time of completion being essential conditions of this contract; and if the Contractor shall fail to complete the work by the time above specified, the sum of _____ per day, for each and every day thereafter, until such completion, shall be deducted from the moneys payable under this contract. This sum shall be in addition to any penalties otherwise specified.

(37.) ASSIGNMENT.

No part of the work herein specified shall be assigned without the written consent of the Sewer Commission, and in no case shall such consent relieve the Contractor or his surety from the obligations herein entered into by the same or change the terms of this agreement.

(38.) CONTRACTORS' DEFAULT - FORFEITURE OF CONTRACT.

The work herein specified shall be prosecuted with such force as the Sewer Commission may deem adquate to its completion within the time specified. If the rate at which the work is performed is not, in the judgement of the Sewer Commission, such as to insure its progress and completion in the time and manner herein specified, or if at any time the Contractor refuses or neglects to prosecute the work with a force sufficient, in the opinion of the Sewer Commission, for its completion within the

specified time, or if, in any event, the Contractor fails to proceed with the work in accordance with the requirements and conditions of these specifications, the Sewer Commission shall have the right and full authority to take the work out of the hands of the Contractor and to employ other workmen to complete the unfinished work, or to relet the same to other contractors, and to deduct the expense occasioned by such default from any money owing to the Contractor.

If the work shall be wholly or in part improperly constructed, the Sewer Commission shall have the right to order the entire reconstruction of the same, and in case the Contractor shall default or refuse to reconstruct any work improperly done, declare the contract for said work forfeited either as to a portion or the whole and to relet the same. In event of such default or forfeiture, the Sewer Commission shall have the right to adjust the difference of damage or price (if there be any) which according to a just and reasonable interpretation of these specifications and contract as a whole, the Contractor should pay to the City of Rushville as damages, for failure to properly commence and prosecut or to properly construct said work in all respects according to the conditions hereinbefore specified, or for any other default; and it is hereby understood and agreed that for the amount of damage or price determined by the Sewer Commission to be paid the City of Rushville, by the contractor for any such default or for any money paid out by the City of Rushville,

on account of the Contractor, in consequence of any default, there shall be applied in payment thereof a like amount of any money that may be due and owing to the Contractor on account of said work, so far as there may be any such money, and so far as the same shall be sufficient, and if there shall not be sufficient amount retained from said Contractor then in such case the amount to be paid to the City of Rushville in consequence of such default shall be a just claim against the Contractor and be recovered from him at law, in the name of the City of Rushville before any court of competent jurisdiction either by suit upon his bond or otherwise.

In case the Sewer Commission deems it necessary to declare any portion or section of the work forfeited, it is expressly stipulated and understood that such declaration of forfeiture shall not in any manner relieve the Contractor from the covenants and conditions of the contract for said work, but the same shall remain valid and binding on said Contractor.

(39.) GUARANTEE.

It is understood and agreed that all labor and material shall be of such character that the entire work, including the restoration of the surface of the street, shall be and remain in good condition during the entire period of one year from the acceptance of the work, and the Contractor hereby agrees to keep in perfect repair,

during such period, the whole of his work, except in cases where the repairs may be rendered necessary by causes clearly beyond his control.

In the event that any pavement, sidewalk, crossing or other surface which may have been disturbed in the prosecution of the work shall not be restored by the Contractor within a reasonable time after the completion of the work and the acceptance of the same by the Sewer Commission, or if any such pavement, sidewalk, crossing or surface, because of the settling of the backfilling, be in bad condition during the period of the year after the acceptance of the work, or if any of the Contractor's work be found defective or incomplete during such period, and the Contractor neglected to repair such defective work within fifteen (15) days from the date of a notice from the Sewer Commission directing him to make such repairs, then the City of Rushville may make such repairs and restoration of the street at the expense of the Contractor, and may deduct the cost thereof from any money belonging to the Contractor that has been retained by the City for that purpose.

And the said _____ Contractor, hereby expressly binds himself to indemnify and save harmless the City of Rushville, from all suits or actions of every name and description brought against the said City, for, or on account of any injuries or damages received or sustained by any party or parties by or from

the said _____
or his servants or agents, in the construction of said work, or by or in consequence of any negligence in guarding the same, or any improper materials used in its construction, or by or on account of any act or ommission of the said _____ or his agents.

(40.) PAYMENT.

In consideration of the completion by said _____ Contractor, party of the second part, af all the work embraced in this contract, in conformity with the specifications and stipulations herein contained, and in strict accordance with the instructions of the Engineer, the City of Rushville, party of the first part, hereby agrees to pay to the said party of the second part, the prices named in the "Proposal" which is hereto annexed, and which is hereby made a part of this contract.

Payments for the work shall be made monthly upon the estimate of the Engineer. Ten percent of the amounts due will be retained as a guarantee against poor workmanship and materials. One-half of this reserve will be paid as soon as the work is completed and accepted and the balance at the expiration of one year after the final acceptance of the work.

IN WITNESS WHEREOF, the City of Rushville has caused its name to be affixed by _____ _____ _____ - ____ thereunto duly authorized, and the said _____ party of the second part _____ hand, the day and year aforesaid.

Attest:

_____

_____

_____

_____

_____

_____

B O N D.

KNOW ALL MEN BY THESE PRESENTS, THAT WE

_____

_____

are held and firmly bound unto the City of Rushville, Illinois, in the sum of _____ Dollars, lawful money of the United States of America, to be paid to the said City of Rushville, or to its certain attorney or assigns, to which payment, well and truly to be made, we bind ourselves, our heirs, executors, and administrators, and each and every of them, firmly by these presents.

Signed and sealed with our seals, and dated at _____, this _____ day of _____ 19___.

THE CONDITION OF THE OBLIGATION IS SUCH, That Whereas, the said _____ _____ ha____ entered into a contract with the City of Rushville, Illinois, bearing date the _____ day of _____ 19___, which said contract is hereunto attached.

NOW, THEREFORE, If the said _____ _____ shall well and truly keep and perform all the terms and

conditions of said contract, on _____ part to be kept and performed, and shall indemnify and save harmless the said City of Rushville, Illinois, as therein stipulated, then this obligation shall be of no effect, but otherwise it shall remain in full force and virtue.

_____ L. S.

_____ L. S.

_____ L. S.

_____ L. S.

ESTIMATE OF
APPROXIMATE COST OF SEWER SYSTEM.

Cost of pipes including "Y" branches,					
16490 feet of	6" pipe	@ $0.16 per lin. ft.	=$2638.40		
24177	8"	@ 0.22	= 5318.94		
1410	10"	@ 0.32	= 451.20		
2720	12"	@ 0.40	= 1088.00		
494	15"	@ 0.54	= 266.76		
					$ 9763.30
Trenching, 35920 cu. yds. @ $0.50 per cu. yd.					17960.00
Cost of laying pipes,					
16490 feet of	6" pipe	@ $0.06 per lin.ft.	=$ 989.40		
24177	8"	@ 0.08	= 1934.16		
1410	10"	@ 0.10	= 141.00		
2720	12"	@ 0.12	= 326.40		
494	15"	@ 0.15	= 74.10		
					3465.06
Appurtenances,					
8	Lamp-holes	@ $15.00	=$ 120.00		
98	Man-holes	@ 40.00	= 3920.00		
44	Flush Tanks	@ 60.00	= 2640.00		
					6680.00
					$37868.36

The pipes are at 70% off list price per lineal foot, plus 10% to cover the cost of branches.

The price for trenching includes excavating, sheeting, bracing and back-filling in earth.

The price of one cent per inch of diameter of pipe per lineal foot laid, includes hauling, labor of laying, and cement for joints.

12.
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12.	13.	
184.90	188.00	
181.70	184.45	
184.45	186.00	
186.00	189.05	
189.05	193.25	
185.01	187.11	
187.11	189.06	
189.06	190.68	
180.40	187.00	
163.99	164.80	
165.17	167.13	
167.13	170.98	
171.15	173.63	
173.63	176.11	
176.11	178.03	
178.03	180.51	
181.15	186.55	1
175.04	176.90	
176.90	178.76	
178.76	180.20	
180.20	182.24	

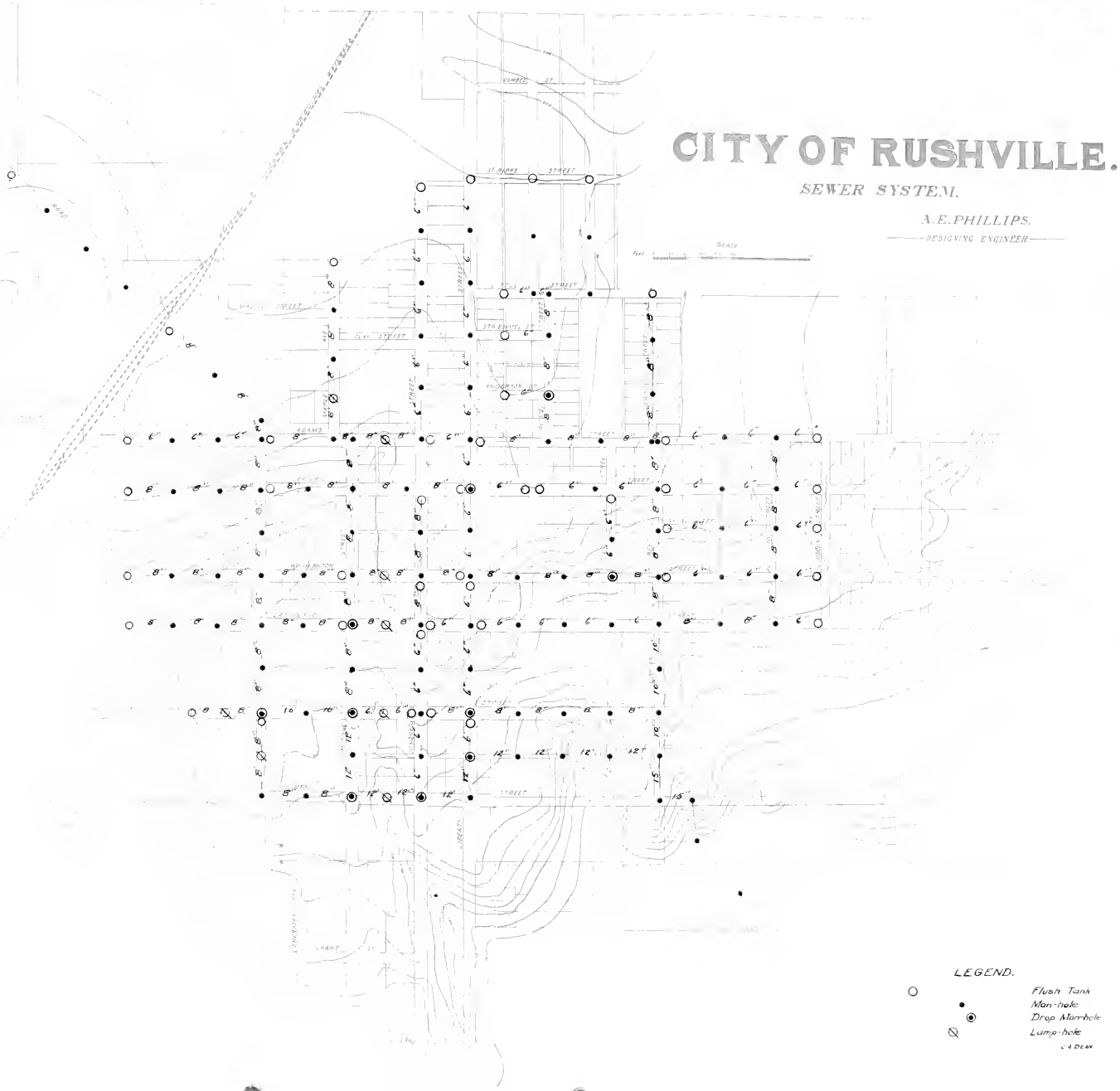
200
195
190
185
180
175
1960 CONGRESS ST.

195
190
185
180
175
LINCOLN ST.
BROADWAY
100 mph
dm = 0.61'
Fig. 8

200
195
190
185
180
175
170
186.00
22+70 ADAMS ST.
472 cu.yd.
dm = 10.45'
.005
6" PIPE

194
192
190
188
186
184
182
CLINTON ST
419 cu.yd.
d_m = 15.25
003
15" PIPE
163.99

TY OF RUSHVILLE.


CITY OF RUSHVILLE.
SEWER SYSTEM.
A.E.PHILLIPS.
DESIGNING ENGINEER
Scale
ST. MARKS STREET
ADAMS
GRANT ST.
LEGEND.
Flush Tank
Man-hole
Drop Manhole
Lamp-hole
C.A.DEAN